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TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No.
YOR920010091US1

Re Application Of: John Michael Cotte, et al.

Serial No.
09/893,207

Filing Date
June 27, 2001

Examiner
Pamela E. Perkins

Group Art Unit
2822

Invention: **PROCESS OF REMOVING RESIDUE MATERIAL FROM A PRECISION SURFACE**

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on March 15, 2004

The fee for filing this Appeal Brief is: \$330.00

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Dated: May 13, 2004

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: John Michael Cotte, et al.

Examiner: Pamela E. Perkins

Serial No: 09/893,207

Art Unit: 2822

Filed: June 27, 2001

Docket: YOR920010091US1 (14299)

**For: PROCESS OF REMOVING
RESIDUE MATERIAL FROM
A PRECISION SURFACE**

Dated: May 13, 2004

Confirmation No.: 5007

Commissioner for Patents
P.O. Box 1450
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Attn: Mail Stop Appeal Brief

APPELLANTS' BRIEF ON APPEAL

1. Real Party in Interest

The real party in interest of the present application is International Business Machines Corporation, the assignee of the entire right, title and interest in the above-identified patent application.

2. Related Appeals and Interferences

No other appeals or interferences are known which directly affect, or will be directly affected by, or have a bearing on, the disposition of the pending appeal.

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3. Status of the Claims

The present application was filed on June 27, 2001 with Claims 1-20. In response to a first Office Action dated October 7, 2002, Appellants filed an Amendment and Response dated January 6, 2003. In the Response, Appellants amended Claim 1. A Final Rejection was issued on February 13, 2003, in which the Examiner maintained the rejections to Claims 1-20. In response to the Final Rejection, dated February 13, 2003, Appellants submitted a Response under 37 C.F.R. §1.116, dated April 14, 2003, in which Appellants amended Claims 1, 2, 3, 12, 13, 15, 16, 17 and 18. An Advisory Action was issued on April 18, 2003. The amendments to Claims 1, 2, 3, 12, 13, 15, 16, 17 and 18 were not entered in the Advisory Action dated April 18, 2003.

A Request for Continued Examination (RCE) was filed on May 13, 2003, requesting entry of the amendments to Claims 1, 2, 3, 12, 13, 15, 16, 17 and 18 made in Appellants' Response of April 14, 2003. A first Office Action in the RCE was issued on June 30, 2003, to which Appellants filed a Response, dated September 30, 2003. A Final Rejection was issued on December 15, 2003. In response to the Final Rejection dated December 15, 2003, Appellants filed a Response under 37 C.F.R. §1.116, dated February 12, 2004. No amendments to the finally rejected claims were submitted with Appellants' Response of February 12, 2004. In response to the Final Rejection, dated December 15, 2003, Appellants' filed a Notice of Appeal on March 15, 2004. An Advisory Action was issued on March 24, 2004 maintaining the rejection of Claims 1-20.

Thus, Claims 1-20 are the subject of this appeal; these claims, as they presently stand, are set forth in the Appendix of this Appeal Brief. The status of each of the claims is thus as follows:

Claims 1-20: Finally rejected and on appeal.

4. Status of the Amendment

A Response to the Final Rejection dated December 15, 2003 containing arguments for patentability was filed on February 12, 2004. No amendments to the claims were filed with the February 12, 2004 Response; hence that Response was entered and considered by the Examiner.

5. Summary of Invention

The invention embodied by Claims 1-20, on appeal, relates to a process of cleaning a precision surface. The inventive process includes contacting a reactive ion etched (RIE) precision surface having vias, cavities, trenches or channels incorporated therein, with a composition that comprises liquid or supercritical carbon dioxide and a fluoride-generating species to remove reactive ion etch residue from the precision surface.

The reactive ion etch residue removed from the precision surface by the inventive process is composed of the following materials: etchant gas material, the material being etched in forming the precision surface as well as polymeric photoresist material, which is used in forming the vias, cavities, trenches or channels of the precision surface. Appellants, observe that at Page 6, lines 5-8, of the specification they have further defined the reactive ion etch residue formed on the RIE precision surfaces to be a polymeric type deposit which resembles polyflouroethylene. More specifically, Appellants disclose that the reactive ion etch residue contains one or more of the following elements: carbon, hydrogen, silicon, aluminum, titanium, tungsten, platinum, palladium, iridium, chromium, fluorine, chlorine, and oxygen.

6. Issues on Appeal

- I. Do the combined disclosures of U.S. Patent No. 6,331,487 to Koch (“Koch”), U.S. Patent No. 6,355,153 to Uzoh, et al. (“Uzoh, et al.”) and U.S. Patent No. 5,897,349 to Agnello (“Agnello”) render Claims 1, 2, 15 and 16, on appeal, unpatentable under 35 U.S.C. §103(a)?
- II. Do the combined disclosures of Koch, Uzoh, et al., Agnello and the article to R. Alm entitled “Formulation Techniques using Triflic Acid Salts” (“Alm”) render Claims 3-14, on appeal, unpatentable under 35 U.S.C. §103(a)?
- III. Do the combined disclosures of Koch, Uzoh, et al., and Agnello and U.S. Patent No. 6,316,057 to Hirayama, et al. (“Hirayama, et al.”) render Claims 17-20, on appeal, unpatentable under 35 U.S.C. §103(a)?

7. Grouping of the Claims

The Claims involved in Issue I stand and fall together.

The Claims involved in Issue II stand and fall together.

The Claims involved in Issue III stand and fall together.

8. Arguments for Patentability

- I. The combined disclosures of Koch, Uzoh, et al. and Agnello do not render Claims 1, 2, 15 and 16, on appeal, unpatentable under 35 U.S.C. §103(a).

In the Final Rejection dated December 15, 2003, Claims 1, 2, 15 and 16 were rejected under 35 U.S.C. §103 as allegedly unpatentable over the combined disclosures of Koch, Uzoh, et

al. and Agnello. Appellants respectfully disagree with the Examiner's conclusion that the combination of Koch, Uzoh, et al. and Agnello renders Appellants' claimed method unpatentable and submit the following.

Appellants submit that the appealed method claims are not rendered obvious by the disclosure of Koch in combination with Uzoh, et al., or further in combination with Agnello, since none of the applied references teaches or suggests Appellants' claimed process of cleaning a precision surface. Appellants' claimed process for cleaning a precision surface comprises contacting a reactive ion etched precision surface having vias, cavities, trenches or channels incorporated therein, the reactive ion etched precision surface containing reactive ion etch residue, with *a composition which comprises liquid or supercritical carbon dioxide and a fluoride-generating species until the reactive ion etch residue is removed from the precision surface*, as recited in Claim 1, on appeal. "To establish a prima facie case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art". *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970). More specifically, none of the applied references provides a cleaning composition that removes reactive ion etch residue from a precision surface, where the integrity of the vias, cavities, trenches or channels of the precision surface are maintained.

Appellants respectfully submit that the appealed claims are not obvious from the disclosure of Koch, since the applied reference does not teach or suggest Appellants' claimed process which removes *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein*. Instead, Koch provides a process for removing chemical mechanical polishing (CMP) residue from a previously polished surface layer. The CMP residue disclosed in Koch contains CMP chemicals (such as a silica-

based or metallic based slurry material) and particles (from the polished surface) that are formed following the CMP process.

In Appellants' claimed process, reactive ion etch residue is removed from a *reactive ion etched* precision surface. The reactive ion etch residue that is removed by Appellants' process is composed of an etchant gas material, the material being etched as well as the polymeric photoresist material, which is used in forming the vias, cavities, trenches or channels. Appellants, referring to Page 6, lines 5-8, of the specification, define the reactive ion etch residue formed on the "RIE precision surfaces, [to be] a polymeric type deposit which resembles polyflouroethylene." More specifically, Appellants disclose that the reactive ion etch residue contains one or more of the following elements: carbon, hydrogen, silicon, aluminum, titanium, tungsten, platinum, palladium, iridium, chromium, fluorine, chlorine, and oxygen. Appellants respectfully submit that the reactive ion etched residue removed by the claimed process is different from the CMP residue that is removed in the process disclosed in Koch.

Appellants further submit that in the claimed process, as recited in Claim 1, on appeal, the reactive ion etch residue is removed from a reactive ion etched precision surface that contains vias, cavities, trenches and channels therein. In contrast thereto, the CMP residue is removed from a surface that has been planarized by a CMP process. As is well known to those skilled in the art, the CMP process is not used in forming precision surfaces that have vias, cavities, trenches, and channels. Instead, the CMP process provides a planarized surface.

Further, Koch teaches away from Appellants' claimed invention, in which a precision surface is cleaned of reactive ion etch residue by a composition comprising liquid or supercritical carbon dioxide and a fluoride-generating species. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the

path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. The degree of teaching away will depend on the facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." *In re Gurly*, 27 F.3d 551, 553, 31 USPQ2d 1130, 1131(Fed. Cir. 1994).

Koch teaches away from Appellants' claimed invention, since planarization, as disclosed in Koch, would fuse particulate matter into the openings of a precision surface. Chemical mechanical polishing utilizes a particulate slurry having a large particle size distribution, in conjunction with a polishing pad, where the polishing pad exerts a downward force on the surface to be polished, to provide a mechanical planarization action. Although Koch fails to teach or suggest a precision surface, had the planarization process disclosed in Koch been applied to a precision surface, the particulate matter of the slurry would be permanently lodged into the openings of the precision surface by the downward force applied by the polishing pad. A person of ordinary skill in the art, upon reading Koch would interpret the reference to teach away from Appellants' claimed process, since the downward force produced by the polishing pad permanently fuses particulate matter into the openings of precision surfaces. Therefore, Koch suggest a line of development that is unlikely to be productive to the result sought by the Appellants, which is to remove residue from the vias, cavities, trenches or channels of a precision surface, as recited in Claim 1, on appeal.

Appellants observe that it is improper to combine references where the references teach away from their combination. *In re Graselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). Therefore, since Koch fails to teach or suggest each and every limitation of Appellants' process and since Koch teaches away from Appellants' process, Appellants' respectfully submit

that Koch does not render Appellants' claimed process unpatentable, as recited in Claim 1, on appeal.

Uzoh, et al. do not alleviate the above deficiencies in Koch, since the applied secondary reference also does not teach or suggest a process for removing reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein, as recited in Claim 1, on appeal. Instead, Uzoh, et al. disclose selectively removing portions of a seed layer 6 from a top surface of a substrate 2 and then depositing a conductive material 8 in the cavities of the substrate, where portions of the seed layer 8 remain in the cavities. Uzoh, et al. further disclose, referring to Column 5, lines 50-53, "a porous pad type material 20 with or without fixed abrasive particles is used to selectively polish the seed layer 6 from the top surface of the substrate." Therefore, Uzoh, et al. disclose an abrasive contact used to planarize or polish a surface, similar to Koch, and is far removed from Appellants' process for removing reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.

Appellants observe that although Uzoh, et al. make reference to reactive ion etching, Uzoh, et al. do not teach or suggest cleaning a reactive ion etched precision surface that contains vias, cavities, trenches, or channels incorporated therein, as recited in Claim 1, on appeal. Uzoh, et al., referring to Column 7, lines 19-24, disclose that, "after depositing the conductive material in the cavities the barrier layer can be removed, by conventional polishing or reactive ion etch (RIE), after selectively removing the barrier layer and planarizing/polishing the top surface of the substrate." Referring to Column 8, lines 9-13, Uzoh, et al. further disclose that, "after depositing the second conductive material 26 on the first conductive material 24, the second conductive material 26 can be planarized using CMP or RIE to form the structure as illustrated in FIG.

3Biid.” Appellants submit that the RIE processing disclosed in Uzoh, et al. is conducted after material has been deposited into the cavities of the substrate in a permanent manner. Since material remains within the cavities of the substrate any later processing steps, whether they include CMP or RIE, cannot remove residue that is already within the cavities of the device. The above noted RIE process steps are employed in a planarizing manner, similar to CMP, and are not utilized in a manner, which allows for reactive ion residue to be removed from the cavities and vias of the precision surface of the substrate. Therefore, Uzoh, et al. do not teach or suggest Appellants’ process for removing reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein, as recited in Claim 1, on appeal.

In addition, Uzoh, et al. teach away from Appellants’ invention, which removes reactive ion etch residue from the vias, trenches, and cavities of the reactive ion etched precision surface. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore and Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983). Uzoh, et al., referring to Column 6, lines 14-19, disclose that “the purpose of applying the electrical potential between the anode 22 and the conducting substrate and generating an electric current *is to avoid the dissolution of the seed layer 6 in the cavities* during the process of polishing the top surface of the substrate.” Therefore, since Uzoh et al. disclose a means for protecting material within the vias, cavities, or trenches of a substrate surface, Uzoh et al. teach away from Appellants’ process of cleaning a reactive ion etched precision surface having vias, cavities, trenches, or channels incorporated therein, as recited in Claim 1, on appeal.

Appellants further note that Uzoh, et al. fail to teach or suggest a composition that comprises liquid or supercritical carbon dioxide and a fluoride-generating species for removing reactive ion etch residue from a precision surface.

Agnello does not alleviate the deficiencies in Koch or Uzoh, et al. since Agnello does not teach or suggest a process for cleaning a precision surface by contacting reactive ion etched precision surfaces having vias, cavities, trenches or channels incorporated therein, the reactive ion etched precision surfaces containing reactive ion etch residue, with a composition which comprises liquid or supercritical carbon dioxide and a fluoride-generating species *until the reactive ion etch residue is removed from the precision surface*, as recited in Claim 1, on appeal. Agnello discloses a process for providing a self-aligned capped conductor suitable for borderless contacts which may be placed on the gate after all front end processing is completed. More specifically, Agnello disclose forming the gate conductor subsequent to the device doping and heat cycles for formulation of the source and drain junction and is far removed from Appellants' process for cleaning precision surfaces.

It appears to be the Examiner's position, as stated on Page 3 of the Final Rejection dated December 15, 2003 and Page 2 of the Advisory Action dated March 24, 2004, that Agnello discloses a process of removing reactive ion etch residue from a precision surface with another reactive ion etch. Appellants submit that by utilizing reactive ion etching to remove etch residue from a precision surface removes the precision surface itself. Referring to the passage cited by the Examiner (see Column 5, lines 55-66), Agnello discloses a process of subtractively etching a layer of Si_3N_4 to form sidewall spacers 18 using a mixture of CF_3 and O_2 . Etch chemistries which subtractively etch material destroy precision surfaces by removing the features of the precision surfaces including: vias, cavities, trenches or channels. Therefore, since Agnello

discloses etch chemistries which remove the features of the precision surface, Agnello fails to teach or suggest cleaning a precision surface *with a composition which comprises liquid or supercritical carbon dioxide and a fluoride-generating species until the reactive ion etch residue is removed from the precision surface*, as recited in Claim 1, on appeal.

Appellants note, referring to Column 5, lines 27-32, a single reference to chemical cleaning to remove reactive ion etch residue, where the chemical cleaning composition include dilute HF etching and etching in sulphuric/peroxide or another acidic or basic peroxide mixtures. Appellants submit that the above cleaning compositions, being aqueous solutions, can not overcome the surface tension of precision surfaces and therefore can not remove reactive ion etch residues from precision surfaces. Appellants have disclosed that the surface tension of the precision surfaces is overcome using liquid or supercritical carbon dioxide. The surface tension of the aqueous based cleaning compositions disclosed in Agnello are about 80 times greater than the surface tension of the cleaning compositions of the present invention, which comprise supercritical or liquid carbon dioxide and a fluorine generating species. The higher surface tension of the aqueous based cleaning composition, disclosed in Agnello, will not wet the precision surface and therefore will not penetrate the vias, cavities, trenches, or channels of the precision surface to remove the RIE residue positioned therein. Therefore, since Agnello fails to teach or suggest liquid or supercritical carbon dioxide or similar cleaning composition, Agnello fails to teach or suggest *removing reactive ion etch residue from a precision surface*, as recited in Claim 1, on appeal.

In view of the above remarks, Appellants respectfully submit that Claims 1, 2, 15 and 16 are patentable subject matter over the combined disclosures of Koch, Uzoh, et al. and Agnello.

II. The combined disclosures of Koch, Uzoh, et al., Agnello and Alm do not render Claims 3-14, on appeal, unpatentable under 35 U.S.C. §103(a).

Claims 3-14 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over the combination of Koch, Uzoh, et al., Agnello and Alm. Claims 3-14 are dependent on independent Claim 1. If an independent claim is non-obvious under 35 U.S.C. §103(a), then any claim depending therefrom is non-obvious. *In re Fine*, 837F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). “To establish a prima facie case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art”. *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970).

Appellants submit that Koch, Uzoh, et al., and Agnello fail to teach or suggest Appellants’ process of cleaning a precision surface, as recited in Claims 1, 2, 15 and 16. Appellants respectfully submit that the above remarks concerning the deficiencies of the Koch, Uzoh, et al., and Agnello apply equally well to the obviousness rejection of Claims 3-14, under 35 U.S.C. §103. Therefore the remarks from Section I of this brief are incorporated by reference.

Alm does not alleviate the above deficiencies in Koch, Agnello or Uzoh, et al., since Alm also does not teach or suggest a process for cleaning a precision surface by removing *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein*. Instead, Alm discloses the use of acid catalysts based on trifluoromethanesulfonic (triflic) acid that, when heated, catalyze the polymerization of cationically sensitive thermoset resin coatings. Appellants respectfully submit that the disclosure of Alm does not teach or suggest that triflic acid or one of its salts can be used in conjunction

with liquid or supercritical fluid carbon dioxide to remove *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.*

In view of the above remarks, Appellants respectfully submit that Claims 3-14 are patentable subject matter over the combined disclosures of Koch, Uzoh, et al., Agnello and Alm.

III. The combined disclosures of Koch, Uzoh, et al., Agnello and Hirayama, et al. do not render Claims 17-20, on appeal, unpatentable under 35 U.S.C. §103(a).

Claims 17-20 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over the combination of Koch, Uzoh, et al., Agnello and Hirayama, et al. Claims 17-20 are dependent on independent Claim 1. If an independent claim is non-obvious under 35 U.S.C. §103(a), then any claim depending therefrom is non-obvious. *In re Fine*, 837F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). “To establish a prima facie case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art”. *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970).

Appellants submit that Koch, Uzoh, et al., and Agnello fail to teach or suggest Appellants’ process of cleaning a precision surface, as recited in Claims 1, 2, 15 and 16. Appellants respectfully submit that the above remarks, concerning the deficiencies of Koch, Uzoh, et al., and Agnello apply equally well to this obviousness rejection of Claims 17-20, under 35 U.S.C. §103. Therefore the remarks from Section I of this brief are incorporated by reference.

Hirayama, et al. do not alleviate the deficiencies in Koch, Uzoh, et al., or Agnello, since the applied secondary reference also does not teach or suggest a process for removing *reactive ion etch residue from a precision surface that contains vias, cavities, trenches or channels incorporated therein*. Instead, Hirayama, et al. disclose a process for coating a surface of a semiconductor device, which comprises the steps of applying a reagent comprising a reactive group selected from Si-H, Sn-H and Ge-H, in the presence of a platinum metal onto a surface that is to be coated. Appellants respectfully submit that Hirayama, et al. do not teach or suggest that the reagent disclosed therein can be used in conjunction with liquid or supercritical fluid carbon dioxide to remove *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein*.

In view of the above remarks, Appellants respectfully submit that Claims 17-20 are patentable subject matter over the combined disclosures of Koch, Uzoh, et al., Agnello and Hirayama, et al.

In addition to the above remark made in Sections I-III of this Brief, Appellants further submit, as a general comment to each issue, that the various rejections, under 35 U.S.C. §103(a), fail because there is no motivation in Koch, Uzoh, et al., Agnello, Alm or Hirayama, et al., which suggest modifying the disclosed processes such that the same can be used to provide Appellants' process as recited in Claim 1, on appeal. Thus, there is no motivation provided in the applied references, or otherwise of record, to make the modification mentioned above. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." *In re Vaeck*, 947 F.2d, 488, 493, 20 USPQ 2d. 1438, 1442 (Fed.Cir. 1991).

There is no motivation to combine Koch, Uzoh, et al., Agnello, Alm and Hirayama, et al., because combining the prior art references would render the primary reference, Koch, unsatisfactory for its intended purpose. To establish a prima facie case of obviousness, the Examiner must show "some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). There is no suggestion to combine, however, if a reference teaches away from its combination with another source. *See In re Fine*, 837 F.2d at 1075, 5 USPQ2d at 1599. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant . . . [or] if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." *In re Gurley*, 27 F.3d 551, 553, 31 USPQ2d 1130, 1131 (Fed. Cir. 1994). If when combined, the references "would produce a seemingly inoperative device," then they teach away from their combination. *In re Spinnoble*, 405 F.2d 578, 587, 160 USPQ 237, 244 (CCPA 1969). If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no motivation to make the proposed modification. *In re Gordan*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In a 1969 decision from the U.S. Court of Customs and Patent Appeals, the Court in *In re Spinnoble* 405 F.2d 578, 160 USPQ 237 (CCPA 1969) held that claims directed to a novel mixing vial were non-obvious, since the combination of the applied references produced an inoperative device. The claimed multicompartment mixing vial included a silicon coated butyl rubber plug separating a liquid-containing chamber from a solid-containing chamber, where the

plug was positioned by sliding engagement. One prior art reference disclosed a butyl rubber sealing ring having a frictional induced rolling action, as opposed to the sliding action of the claimed seal plug. The court noted that since the sliding action of the center plug was essential to the claimed invention, the frictional sealing ring *was totally incapable of serving the appellants' purposes*. See *In re Spinnable* 160 USPQ at 244. The Court held that the proposed modification to the prior art produced an inoperable device and therefore could not support an obviousness rejection under 35 U.S.C. §103.

Appellants submit that modification of Koch as proposed by the Examiner, similar to the modifications of the prior art discussed by the court in *In re Spinnable*, produces an inoperative process. One object of the Appellants' claimed process is to remove reactive ion etch residue that is positioned within the vias, cavities and trenches of a precision surface. The primary reference, Koch, as applied by the Examiner, discloses chemical mechanical polishing (CMP) methods. Chemical mechanical polishing (CMP) of a precision surface destroys the precision surface by removing the vias, cavities, and trenches formed therein. Chemical mechanical polishing (CMP) utilizes a slurry of particulate matter to polish a surface through the application of force exerted by a polishing pad. During polishing particulate matter from the slurry is physically fused into the openings of the precision surface so that the particulate matter could not be removed using cleaning compositions. Similar to the prior art examined in *In re Spinnable*, Koch is totally incapable of serving the Appellants' purposes, since Koch would permanently introduce particulate matter into the precision surface, whereas Appellants' remove reactive ion etch residue from a precision surface. Therefore, modifying Koch to provide Appellants' process results in an inoperative process, since Koch discloses a process that physically fuses

particulate matter into the openings of the precision surface in a manner that could not be removed using chemical cleaning processes.

Further, the combination of the prior art cannot change the principle of operation of the primary reference. It is the Examiner's position that it would have been obvious to one of ordinary skill in the art to modify Koch by removing reactive ion etch residue using an additional reaction ion etch, as taught by Agnello. The passage of Agnello cited by the Examiner discloses forming sidewall spacers by a subtractive etch using a mixture of CF_3 and O_2 . *See* Column 5, lines 55-66. The purpose of the process disclosed in Koch is to remove CMP residue without introducing defects or scratches to the polished substrate surface. *See* Koch, et al. Column 1, lines 45-48, and Column 4, lines 21-25. Appellants submit that the cleaning the polished surface of Koch with the etch process disclosed in Agnello could destroy the polished character of the surface and therefore would change the principle of operation of the primary reference.

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *See In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). Combinations of references that require a substantial reconstruction and redesign of the elements shown in the primary reference as well as a change in the basic principle under which the primary reference construction was designed to operate may negate a *prima facie* case of obviousness. *See In re Ratti*, 270 F.2d at 813, 123 USPQ at 352. Incorporating the subtractive etch process disclosed in Agnello into the Koch CMP polishing process removes material from the CMP polished surface, effectively destroying the polished character of the substrate and producing defects. Therefore, since the application of the etch process from Angello destroys the

polished surface disclosed in Koch the combination substantially changes the basic principal under which Koch operates. Therefore, there is no motivation to combine the applied references.

In view of the above remarks, Appellants respectfully submit that Claims 1-20 are patentable subject matter over the combined disclosures of Koch, Uzoh, et al., Agnello, Alm and Hirayama, et al.

9. Conclusion

The above arguments establish that all of the claims on appeal are enabled, definite and patentable over the substantive grounds of rejection raised in the Final Rejection. Appellants therefore respectfully request that the substantive grounds used in rejecting Claims 1-20, on appeal, made by the Examiner, be reversed by the Board of Patent Appeals and Interferences.

Respectfully submitted,



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APPENDIX

10. The claims on appeal for U.S. Application Serial No. 09/893,207, filed June 27, 2001

1. A process of cleaning a precision surface comprising contacting a reactive ion etched precision surface having vias, cavities, trenches or channels incorporated therein, said reactive ion etched precision surface containing reactive ion etch residue, with a composition which comprises liquid or supercritical carbon dioxide and a fluoride-generating species until the reactive ion etch residue is removed from the precision surface.
2. A process in accordance with Claim 1 wherein said fluoride-generating species is a fluorine-containing acid.
3. A process in accordance with Claim 2 wherein said fluorine-containing acid is selected from the group consisting of hydrogen fluoride, fluorosulfonic acid and perfluorosulfonic acid.
4. A process in accordance with Claim 1 wherein said fluoride-generating species is a fluorine-containing acid amine adduct.
5. A process in accordance with Claim 4 wherein said fluorine-containing amine adduct is pyridine:hydrogen fluoride, amine:hydrogen fluoride or an alkylamine:hydrogen fluoride.

6. A process in accordance with Claim 1 wherein said fluoride-generating species is an amine fluoride.
7. A process in accordance with Claim 1 wherein said fluoride-generating species is a quaternary amine fluoride.
8. A process in accordance with Claim 7 wherein said quaternary amine fluoride is selected from the group consisting of a tetraalkylammonium fluoride and a perfluoroalkylammonium fluoride.
9. A process in accordance with Claim 1 wherein said fluoride-generating species is a perfluororalkylsulfonyl fluoride.
10. A process in accordance with Claim 9 wherein said perfluororalkylsulfonyl fluoride is trifluoromethylsulfonyl fluoride or perfluorooctylsulfonyl fluoride.
11. A process in accordance with Claim 1 wherein said fluoride-generating species is an alkylsulfonyl fluoride.
12. A process in accordance with Claim 1 wherein said fluoride-generating species is an arylsulfonyl fluoride.
13. A process in accordance with Claim 1 wherein said fluoride-generating species is an onium salt-containing fluorine.

14. A process in accordance with Claim 13 wherein said onium salt containing fluorine is selected from the group consisting of benzene diazonium fluoride and benzene diazonium tetrafluoroborate.

15. A process in accordance with Claim 1 wherein said composition includes a component selected from the group consisting of a surfactant, a co-solvent and mixtures thereof.

16. A process in accordance with Claim 1 wherein said contact between said reactive ion etched precision surface and said composition occurs at a pressure in the range of between about 1,000 psi and about 6,000 psi and at a temperature in the range of between about 40°C and about 100°C.

17. A process in accordance with Claim 1 wherein said reactive ion etched precision surface is provided by a semiconductor sample, a metal selected from the group consisting of aluminum, silicon, tungsten, titanium, tantalum, platinum, palladium, iridium, chromium, copper and silver, a polymer selected from the group consisting of polyimides and polyamides or insulators.

18. A process in accordance with Claim 17 wherein said reactive ion etched precision surface is provided by a semiconductor sample.

19. A process in accordance with Claim 18 wherein said semiconductor sample is selected from the group consisting of a semiconductor wafer, a semiconductor chip, a ceramic substrate and a patterned film structure.

20. A process in accordance with Claim 19 wherein said semiconductor sample is a semiconductor wafer.